

VOICE OF THE MIND
The Amazing Power of Story
(And What It Means to You)
A Summary of Recent Research

by

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Question:

Does the **form and structure** of narrative presentation affect reader/viewer:

- **Understanding,**
- Ability to create **meaning,**
- **Retention** (memory & recall)

From the scientific information, concepts, and research you describe?

Not only YES.....

But

HELL, YES!!!

The Central Thesis:

Research clearly shows that **STORY** architecture:

- Provides superior **retention** (memory and recall)
 - Provides Improved **understanding**
 - Makes readers **pay attention** more
 - Enhances the creation of **meaning**

DO STORIES “WORK”?

1. Anecdotal Evidence from 100 storytellers and 1,800 practitioners
2. 300 Qualitative Studies
3. 100 Quantitative Studies

All—ALL— come to the same conclusion.

Examples of what they say:

Trousdale (1990). "Story structure provides a successful framework to allow children to structure, understand, and create meaning for sequential events."

NCTE (1997). "Story is the best vehicle for passing on factual information. The facts about how plants and animals develop, how numbers work—any topic for that matter—can be incorporated into story form and made more memorable."

Swatton (1999). "Stories (structure of) are integral to the ability to have information and experience make sense to our lives."

Mehl-Madrona (2005). "Stories rather than logical arguments or lawful formulations, are the vehicles by which that meaning is communicated."

Herndon & Kreps (1995) "Stories bring evidence to life."

Boyce (1996). "Behind the narrative study of *how* stories affect (even control) life, is the more basic truth *that* stories are the most basic form used to filter, internalize, make sense of, and evaluate new experiences and information."

Spicer (1998). "Narrative fulfills critical sense-making function."

And.....

Spicer (1998). "If you can't see the story; you won't learn the content and its meaning."

Babrow (2005). "Stories provide a way to make sense of experience. Stories provide particularly important ways of understanding uncertain experiences that challenge what had previously been taken for granted."

Harter, et al (2005). "All studies (he sites hundreds) confirm the cognitive value and meaning enhancement from stories."

Mello (2001). "Stories are an effective learning tool that linked literature to content and experience in order to increase memory and retention."

Meyer (1995). "Story structure allows students to make sense of experience."

Clandinin (2000). "Narrative is the best way of representing and understanding experience."

Coles (1989). "Stories enhanced and accelerated virtually every measurable aspect of learning!"

Ambruster (1987). "Research documents that children have more difficulty comprehending expository than narrative texts."

And from other fields....

Clandinin & Connelly (2000). "Narrative structure is an essential aspect of the human mind and is used to interpret information and to make meaning."

Boyce (1996). "In all referenced studies, researchers had to place collected data within the context and structure of a story in order to create meaning and to make sense of organizational communications."

Denning (2001). "Time after time, when faced with the task of persuading a group of managers or front-line staff in a large organization to get enthusiastic about a major change, storytelling was the only thing that worked."

Kahn (2001). "Storytelling is increasingly seen as an important tool for communicating explicit and especially tacit knowledge—not just information, but know-how."

Snowden (2000). "In organizations, stories are uniquely effective as research tools, managerial tools, internal and external communications tools, organizational analysis tools, and as motivation and identity tools."

Polkinghorne (1988). "We use narrative explanations to understand why people behave the way they do."

Some directly discuss science writing...

Howard (1991). "Science is a form of storytelling. Science meaning is constructed and conveyed through storytelling and story structure."

Howard (1998). "The scientific style is the inferior in many ways because of the enormous number of limitations by which it is encumbered."

Coles (1989). "Stories provide an additional kind of truth besides scientific fact. This is character truth that creates context, relevance, and empathy for both factual information and for struggles of characters."

Tannen (1999). "The structural form of story carries power and appeal that is intentionally removed from what is commonly called scientific expository prose."

Schank (2000). "People understand the world in terms of stories that they have already understood. New events or information are understood by reference to old, previously understood, stories and explained to others by the use of stories."

The Problems with “*STORY*”

1. Story *misconceptions* and *myths*
2. No one has thought to *define* “story” from any viewpoint more rational than *personal preference.*

Story Myths & Misconceptions

- Stories = **fiction**, are only **good** for **fiction**.
 - Stories = **lies**.
- Stories are **inappropriate** for factual & **scientific** information, for **nonfiction** reporting.
- People **won't believe** you if you have to resort to telling stories.
- Stories **waste time** by requiring needless details.
- Your arguments must be **weak** if you have to resort to stories.

The Goal of Defining **STORY**:

Articulate a specific, concrete **story architecture** that will improve Reader/Viewer :

- Attention to,
- Development of meaning and understanding from,
- Retention of,
- Memory and recall of

Presented concepts, data, arguments and conclusions.

Examples of **worthless** definitions...

Dalkir (2004). "Storytelling suffers from one of the major obstacles still encountered in KM (knowledge management); namely, reaching agreement among practitioners and scholars about what storytelling is and what it is not."

Blythe, et al (2004): "the narrative accounts of events and experiences, real or fictitious. They can be spoken or written and depict past, present, or future events."

Bal (1985). "Narrative text is a text in which an agent relates a narrative."

Turner (1996). **STORY:** something unusual and interesting.

Story: small spatial event. Just an agent (character or object) and an action.

Silkur (2003). "Story may be defined as the telling of a happening or a connected series of happenings, whether true or fictitious."

Ricoeur (1982). "A story describes a sequence of actions and experiences of a certain number of characters, whether real or imaginary."

Denning (2001). Stories are entertaining and memorable communication events that help people understand complexities and illuminate new perspectives.

What the **Dictionary** says:

Story: A narrative account of a real or imagined event or events.

HE WENT TO THE STORE.

The dictionary is **wrong!**

And we are left without an **understanding** of
what a **story** is or how to use this mighty
architecture.

My Methodology:.....

Search for a confluence of research about the **human brain** and **mind**
from the fields of:

Neural biology & linguistics

Developmental psychology

Computer neural net modeling

Information Science & knowledge management

Cognitive Sciences

Education

to construct a more accurate and useful definition of
STORY.

Brain Anatomy:

- The average brain has: **100 billion** brain cells that send out **500 trillion** axons and dendrites.
- 4 weeks after conception, a human embryo produces **500,000 neurons** every minute.
- During the first two trimesters, neurons begin to stretch tentacles out to each other, establishing **synapses** at the rate of **1 million** a second!
- **3 months** before birth, a baby's brain has **more neurons** than at any other time in its life.

Brain Monitoring Technology

CT (CAT--computerized axial tomography), MRI, fMRI (functional MRI), EEG, PET (positron emission tomography) and OIS (optical imaging of intrinsic signals)

track

- Real time electrical activity
 - Blood consumption
 - Oxygen consumption
 - Glucose consumption
 - Metabolic activity
- Tiny shifts in brain shape and color
- Shifts in the way light is reflected off of the brain

Your brain is **hardwired** for **stories**.

Bruner (1998). “Humans have an inherent readiness or predisposition to organize experience into story form: into viewpoints, characters, intentions, sequential plot structures, and the rest.”

PINKER (2000). “100,000 years of evolutionary preference for, and reliance on, **STORY** has built into the human genetic code instructions to wire the brain to think in story terms by birth.”

McAdams (1993). “It is because of the narrative nature of human minds at and before birth that we are impelled as adults to make sense of our lives in terms of narrative.”

The Brain's Story Predisposition Is Reinforced and Strengthened as the Brain Develops.

Kotulak (1999). "Cells that fire together, wire together."

Applebee (1998). "The child begins quite early to make use of the conventions of story to interpret their direct experiences of the world."

Johnson (1993). "Small children first encounter rational explanation in story form."

Ambruster (1997). Research documents that children have more difficulty comprehending expository than story texts.

Nelson (2003). "Infants and toddlers use narrative to explain and to create meaning because that's what parents and their culture do."

Kotulak (1999). "Beyond the age of about 12, the brain's physical, neural 'maps' have been made."

SUMMARY:

The human brain is predisposed to think in *story terms*. This predisposition is continuously *reinforced* and *strengthened* as the brain develops up through age 12. Adults arrive dependent on interpreting events and other human's behavior through a specific *story architecture*.

The Mind
is what
the brain does.

Recent **psychological** studies, **cognitive science** studies (all backed by computer neural net modeling) have demonstrated **how the mind thinks and remembers**.

New diagnostic and investigative **technology** and **equipment** has not contradicted the developmental theory from the 1960's, '70's, and '80's. Rather, it has **enhanced and confirmed** it.

We **assume** that sensory input **makes sense** and create missing information accordingly (using existing mental maps).

- How **visual illusion** works.

Sperber & Wilson (2002). “We characteristically assume that what somebody says *must* make sense, and we will, when in doubt about what sense it makes, invent an interpretation based on our individual mental maps and prior knowledge.

Bransford (1993). “Readers assume that a text does make sense and will use prior knowledge and story structure to construct any missing elements.”

EXAMPLES:

"Where's John?"

"Well...I didn't want to say anything. But I saw a green VW parked in front of Carol's."

"Hi, Ken."

*"No! I'm **not** Ken. I'm not here. I'm not here!"*

We work with **partial information** and have developed **mental structures to create meaning** with partial info.

Pinker (1997). “The brain can process limited amounts of information, so instead of complete analyses, it relies on crude RULES OF THUMB. One rule is: events have causes in past events (temporal sequencing). One is: actions are driven by beliefs and goals. One is: human behavior follows predictable patterns based on goal attainment.”

Bransford (2000). “Particularly important is the finding that the mind imposes narrative structure on the temporal and human information available from experience and then interprets (creates meaning for) experience through this structure.”

Examples:

You see a woman slumped on a bench crying, dress smeared
with grass and dirt...

and assume there is a logical reason for it, that something happened to her
(in the recent past) to make her cry.

You see a man chasing a dog....

and assume the man wants to catch the dog and that the dog has done
something to deserve the man's pursuit.

You see a black rock against white snow...

and assume even lighting.

You see black and white dots on a screen...

and mentally assume it's a 3-dimensional reality

Mental **story maps** are how humans **make sense** of other humans behavior and **create meaning** from sensory input.

Polkinghorne (1998). "Narrative is a scheme by means of which human beings give meaning to their experiences of temporality and personal action."

Turner (1996). "Human minds operate by structuring input and experience into stories. Mental processing requires source story, target story and projection of source onto target allowing for future prediction. We think, remember, and process in terms of story."

Pinker (1997). "Many scientists believe that the mind is equipped with innate narrative modules (maps) for making sense of the world."

Bruner (1990). Psychologists have learned that 'fictional' story forms provide the structural lines in terms of which 'real lives' are organized."

Turner (1996). "Story is a basic principle of mind."

Bruner (1987). "My life as a student of the mind has taught me one incontrovertible lesson. Mind is never free of precommitment. Our precommitment about the nature of a life is that it is a story."

Humans use **mental maps** (cheat sheets) to process incomplete sensory input and to **combine our interpretation** of that input with existing banks of experience to make it **make sense**.

What mental maps, schema, systems, and cheat sheets do human adults poses to interpret human behavior and temporal input?

Story architecture!

MIND MECHANISMS

Human minds use a number of specific mechanisms to accomplish this.

Metaphor/Parable

Correlation/Prior Knowledge/Pattern matching

Inference/Elaboration

Mapping/Schema

Cheat Sheets/Framing

Language (& Grammar)

Relevance/Context/Empathy

Metaphor/Parable

Pinker (1997). "Mental metaphors form Rules of Thumb. Events are explained as an agent exerting force and will to overcome resistance."

Lakoff and Johnson (2003). "Argument is war. Argument is a dance. Argument is a fight. Argument is a gift of energy and idea." The metaphor you choose defines how you create meaning and how you understand the world.

Lakoff and Johnson (2003). "We have found that metaphors allow us to understand one domain of experience in terms of another."

Example: AFFECTION IS WARMTH. "He's a warm person." "She's cold." "She's like ice today." Built from infancy experience of being held (affection) and warmth of physical human body.

Correlation & Prior Knowledge

Bransford (1993). An example of the value of prior knowledge to use for elaboration and the subsequent value of elaboration to memory.

Consider the following sentences:

John walked on the roof.

Bill picked up the eggs.

Pete hid the ax.

Jim flew the kite.

Frank built the boat.

Harvey flipped the electric switch.

Ted wrote the play.

How many can you remember?

Who build the boat? Who flew the kite? Etc.?

You understood the sentences, but have no context or relevance for them and so weren't able to remember them.

Now lets shift the **character** to invoke **prior knowledge** to aid in
your **understanding** (creating meaning) and **memory**.

Santa Clause walked on the roof.
The Easter Bunny picked up the eggs.
George Washington hid the ax.
Benjamin Franklin flew the kite.
Noah built the boat.
Thomas Edison flipped the electric switch.
William Shakespeare wrote the play.

Another example:

Bransford (1993). Compare how you understand and remember these two paragraphs:

Paragraph #1

A thirsty ant went to the river. He was carried away by the rush of the stream and was about to drown. A dove, sitting in a tree overhanging the water, plucked a leaf. The leaf fell into the stream close to the ant and the ant climbed onto it. The ant floated safely to the bank. Shortly after, a birdcatcher came and laid a trap in the tree. The ant bit and stung him on the foot. In pain, the birdcatcher threw down his trap. The noise made the dove fly away.

Now compare with paragraph #1.

Pete argued that data gathered from a NASA voyage to Venus called into question current theories about the formation of our solar system. Part of his talk emphasized the importance of mass spectrometers. He then discussed the isotopes of argon ³⁶ and argon ³⁸ and noted that they were of higher density than expected. He also cited the high values of neon found in the atmosphere. He has a paper that is already written, but he was aware of the need for further investigation as well.

Cooper (1997). "Many studies have shown that prior knowledge greatly influences comprehension & memory."

Inference/Elaboration

Bransford (1998). “If you **know a lot** about a topic, it is much easier to elaborate on, and to create meaning from, the information and remember what you have read or heard.”

Bransford (1998). “When a topic is **unfamiliar** to readers/listeners, research shows that the natural tendency is to use familiar story structure with character goal, motive, and struggles to elaborate on available information and to provide mapping structures to bring prior knowledge and experience to bear on the interpretation of current input.”

EXAMPLE:

Consider the following sentence:

John was late to work because of the snow.

Most people automatically **elaborate** this sentence by:

- a) Remembering snow experiences they've had.
- b) Remembering their own struggling-to-get-to-work experiences.

PROBLEM: Readers/listeners **automatically** do this. The **story creator** must anticipate and control this elaboration to produce the desired understanding and interpretation of the provided explicit information.

Mapping/Schema

Schema: a mental image produced in response to a stimulus that becomes a framework or basis for analyzing or responding to other related stimuli.

Lakoff and Johnson (2003) "Neural Mapping is not an abstract, metaphoric process. It is an observable, physical process that creates metaphoric structures and thinking in the mind. The maps are physical links; neural circuitry linking neural clusters called nodes. The domains are highly structured neural ensembles in different regions of the brain."

Bower & Morrow (2001). "Readers tend to remember the mental model they constructed from a text, rather than the text, itself."

Story Elements

(Causality/Agent/Intent/Conflicts/Details/Actions)

1. Goal:

Bransford (1993). He offers this paragraph:

Sally let loose a team of gophers. The plan backfired when a dog chased them away. She then threw a party but the guests failed to bring their motorcycles. Furthermore, her stereo system was not loud enough. Sally spent the next day looking for a "Peeping Tom" but was unable to find one in the Yellow Pages. Obscene phone calls gave her some hope until the number was changed. It was the installation of a blinking neon light across the street that finally did the trick. Sally framed the ad from the classified section and now has it hanging on her wall.

Let's add **goal and motive (intent)**:

Sally hates the woman who moved in next door and wants to drive her out.

Now reread the paragraph and see if your mind doesn't conjure images and sequences that make sense to you.

Sally let loose a team of gophers. The plan backfired when a dog chased them away. She then threw a party but the guests failed to bring their motorcycles. Furthermore, her stereo system was not loud enough. Sally spent the next day looking for a "Peeping Tom" but was unable to find one in the Yellow Pages. Obscene phone calls gave her some hope until the number was changed. It was the installation of a blinking neon light across the street that finally did the trick. Sally framed the ad from the classified section and now has it hanging on her wall.

Human minds automatically seek (or create) key story elements.

Pinker (1997). "Here is the gist of a movie. A protagonist strives to attain a goal. An antagonist interferes. Thanks to a helper, the protagonist finally succeeds. This movie....stars are three dots. One dot moves some distance up an inclined line, back down, and up again, almost reaching the top. Another abruptly collides with it, and it moves back down. A third gently touches it and moves together with it to the top of the incline."

"All observers see the first dot as *trying* to reach the top, the second as *hindering* it, and the third as *helping* it to reach its goal."

"People interpret objects as animate agents and assign goal, motive, intent, conflicts, and values to all actions. Agents propel themselves in service of a goal."

And this....

Pinker (1997). "The elements of this story frame (architecture) are universal. Research with 12-month olds shows that babies interpret cartoons of moving dots as if the dots were seeking goals with purpose and intent."

Pinker (1997). "Intelligence is the ability to attain goals in the face of obstacles by means of decisions and actions based on rational rules. The quality 'intelligence' is awarded to those who follow story structure."

Pinker (1997). "Beliefs and goals (wants) drive rational behavior. If we are to understand behavior, we must understand beliefs and goals."

EXAMPLE:

Sally smells smoke and leaves the building.

PROBLEM:

Humans make decisions based on partial information. So we use cheat sheets (mental maps) to fill in the "**most probable**" truth. The map humans tend to use most to explain human behavior is story structure.

An Example:

“John felt lonely.” “He rang the neighbor’s doorbell.”

1. We assume, and try to forcibly construct, a logical linkage between the two sentences. To do that,
2. We assume he doesn’t want to feel lonely (problem)
3. We assume that he wanted company. (goal)
4. We assume that he believes that company will relieve his loneliness. (motive)
5. We assume that he went next door and rang the bell in order to achieve that goal. (struggles and goal resolution)

Bruner (1990). “Research clearly shows that a young child is early and profoundly sensitive to ‘goals,’ ‘motives’ and their achievement.” (“All gone.” “Uh oh.”)

Another Example:

Bransford (1993). Intent (goal & motive) create the mental frame that creates meaning and relevance.

Read once and try to remember:

The fat one bought the padlock.

The skinny one purchased the scissors.

The toothless one plugged in the cord.

The barefoot one climbed the steps.

The bald one cut out the coupon.

The blind one closed the bag.

The kind one opened the milk.

The poor one entered the museum

Do you remember which one purchased scissors? Which cut out a coupon?
Which one climbed steps? Etc. Etc.

Probably not.

Now reread with the addition of a stated (or implied) goal.

The fat one bought the padlock to place on the refrigerator door.
The skinny one purchased the scissors to use when taking in her pants.
The toothless one plugged in the cord to the food blender.
The barefoot one climbed the steps leading to the vat of grapes.
The bald one cut out the coupon for a hair restoration clinic.
The blind one closed the bag after feeding her seeing-eye dog.
The kind one opened the milk to give to a hungry child.
The poor one entered the museum to find shelter from the snowstorm.

Intent (goal & motive) creates context, meaning, relevance and memory.

Details

Tannen (1999). "Narrative details create mental images, making possible both understanding and memory."

Tannen (1999). "Images (created by details), my research suggests, are more convincing and more memorable than either fact or abstract propositions."

Language/Grammar

Pinker (2000). Every culture acquires language and grammar as their primary communication strategy to express story structure and concepts.”

Pinker (2000). “Meaning is conveyed not through vocabulary, itself, but through the way combinations of words are built into sentences and combinations of sentences are built into stories.”

Example from Chomsky (1991): Consider the sentence:
Colorless green ideas sleep furiously.

Example:

Man bites dog.

Dog bites man.

Man, dog, bite.

Bite man, dog.

Some research is specific to science writing.

Hobbs (1990). "My conclusion: novels are interpreted like experiments. Readers explore the consequences of varying one or more parameters within the fictional world while holding all other aspects constant. The reverse is equally true. Readers interpret experiments like novels."

Polkinghorne (1998). "Paradigmatic (scientific) truth should be time independent ($E=mc^2$ doesn't depend on which day it is). To make that truth relevant to time-dependent humans, place the truth within time-dependent sequencing, within narrative (story) structure."

Polkinghorne (1998). "Narratives have application and value in science, therapy, history, natural and physical science, human science, etc. Story form is universal."

Fact Is Made Relevant by Turning It into **STORY**.

Turner (1996). "Science writings imply (bury) most of the key story elements. Make those explicit and story turns into **STORY!**"

EXAMPLE: ***Mother pours milk into a glass.*** (an event—story)

Unstated: goal/motive/resolution/obstacles

Make those explicit: Mother has been crippled by a stroke. Left side paralyzed. Fights to regain use of left hand and arm. Obstacles: grip, gravity, slips, spills, missing the glass, overfilling the glass, embarrassment, etc. This is the first time she has tried a complex action with her left hand. She is determined to pour the milk to prove that she can....

Now its a **STORY!**

A **summary** of how the **mind works**.

Human minds work with narrative input through simple sequential questions:

1. Should I **pay attention**?
2. How can I **interpret and understand** what I received?
3. What of my **experience** and **prior knowledge** applies here?
4. So, what does this **mean** to me?
5. File to **memory**.

HOW MEMORY WORKS

(How—and why—something, once created, gets remembered and recalled.)

HOW MEMORY WORKS...

Smith (2003). "Vivid memories have four features:

- they break an ordinary expectation,
- they are consequential (have impact) for the individual,
- they involve emotional charge,
- they have symbolic value (relevance and context)."

Schachter (1995). "The output of human memory differs—often substantially—from the input.....Remembering can fail not only because information is forgotten over time, but also because it is changed and distorted."

Rubin and Greenberg (2003). "The same areas of the brain are engaged and activated for recall of true (experienced) and false (not experienced) words and events. The mental frameworks used during the interpretation of true events (story structure) induces the mind to augment true memory with false memories that are as compelling to the individual as the true memory."

And....

Ambruster (1987). "Recent research suggests that text structure is an important determinant of text comprehension and memory."

Anderson (1999). "The personal relevance of an event determines the likelihood of memory storage and the ease of retrieval. The density of attached sensory details affects relevance determination and assigned memory storage location."

Anderson (1999). "Mental mapping and rule systems that have been requested from memory many times in the past are assumed by the mind to be more likely to be needed in the present and are more likely to be recalled and applied to present narrative information input."

Mandler (1994). *Experiences not framed into story suffer loss in memory.*

And....

Bransford (1993). "Memory is affected by our ability to relate new information to previous experience and knowledge."

Foer (2006). "The more resonant the images, the more difficult to forget.

- Memory champions link what they want to remember to colors, familiar names, events, visual images, and then string them along familiar paths to associate more of their already established sensory images with a new bit of information to remember.
- They remember by creating a story that provides context and relevance for meaningless information."

Foer (2006). "S. V. Shereshevski struggled to learn how to forget so that less meaningless stuff was jammed into his head. How did he forget? By convincing himself that the information he wanted to forget had no meaning or relevance to him."

The Elements of Story

From this combined research we can identify eight specific elements that define successful stories.

THE EIGHT ESSENTIAL ELEMENTS

Of Every Story/Narrative

1. Who is the **MAIN CHARACTER**?
2. What **CHARACTER TRAITS** make them interesting and relevant?
3. What do the character need to do or get (**GOAL**)?
4. Why is that goal important (**MOTIVE**)?
5. What **CONFLICTS/PROBLEMS** block the character?
6. How do they create **RISK & DANGER**?
7. What does the character do (**STRUGGLES**) to reach the goal?
8. What sensory **DETAILS** will make the story seem *Real*?

A BETTER DEFINITION,

What we *really* mean by the word
STORY:

A *character-based* narrative account of a character's *struggles* to overcome *obstacles* and reach a defined and *important goal* presented in sufficient *detail* to make the story real, vivid, and memorable.

Short Version: *Characters at war.*

What the definition **means**:

A word on **FICTION** and **NONFICTION**,

We associate **NONFICTION** with Reality, Truth, Facts
FICTION with False, Made-Up, Lies, Stories

BUT:

1. Mental processes that create **MEANING** and **UNDERSTANDING**
fictionalize.
2. Mental acts of **INTERPRETING** and **REMEMBERING** *fictionalize.*
3. The writing process automatically *fictionalizes.*

The *REAL* difference
between “*Fiction*” and “*Nonfiction*”;

“*Fiction* Presents Fiction (Stories) About Events
That Haven’t Happened Yet....

“*Nonfiction* Present Fictionalized Stories About Events That
Have.”

APPLYING THE DEFINITION
to
SCIENCE OUTREACH WRITING

Goal: adapt story elements and architecture to increase attention, retention, memory, meaning, understanding, accuracy, and recall.

APPLYING THE DEFINITION TO SCIENCE OUTREACH WRITING

- “Family” stories—the science problem
- Story Architecture—the science outreach answer
 - Put a face on it (left implicit in family stories)
 - Create context, empathy, and relevance through character
 - Provide explicit goal & motive (left implicit in family stories)
- Help reader create meaning and understanding—write to their existing mental maps, cheat sheets, and knowledge base
- Sensory details of scenes, events, human reaction/interaction activate reader mental maps and experiential banks to create relevance, context, and empathy.